Retraction

Retracted: The Application of Interactive Visualization and Computer Vision in Intelligent Education Based on Big Data AI Technology

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This article has been retracted by Hindawi, as publisher, following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of systematic manipulation of the publication and peer-review process. We cannot, therefore, vouch for the reliability or integrity of this article.

Please note that this notice is intended solely to alert readers that the peer-review process of this article has been compromised.

Wiley and Hindawi regret that the usual quality checks did not identify these issues before publication and have since put additional measures in place to safeguard research integrity.

We wish to credit our Research Integrity and Research Publishing teams and anonymous and named external researchers and research integrity experts for contributing to this investigation.

The corresponding author, as the representative of all authors, has been given the opportunity to register their agreement or disagreement to this retraction. We have kept a record of any response received.

References

Research Article
The Application of Interactive Visualization and Computer Vision in Intelligent Education Based on Big Data AI Technology

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Considering the problem that teachers’ command gesture tracking error is due to their poor detection ability in the intelligent education of big data or technology, the application method of interactive visualization and computer vision in the intelligent education of big data or technology is designed. Three-dimensional coordinate transformations of teaching content information and visual processing of teaching information. Use computer vision to detect teachers’ actions and complete computer vision detection of interactive teaching. Using the rendering algorithm, the AI education environment is optimized without affecting computer vision detection. So far, the interactive visualization and computer vision application method design in intelligent big data technology education has been completed. The experimental results show that combining these two technologies can significantly improve the tracking effect of teachers’ instruction gestures, optimize the design effect of teaching content, and raise teaching levels.

1. Introduction

With the development of the Internet, intelligent devices continue to push through the old and bring forth the new. Various information presentation methods of information visualization have been gradually integrated into our life. A large amount of information data such as weather conditions, map navigation, and stock funds have become an indispensable part of our life. Human computer interaction is a technology that studies the information exchange between human and computer, which has far-reaching consequences in many aspects of human life. This technology involves many different fields such as information science, intelligent science, neuroscience, physiology, and psychology. It directs the cutting edge of information and computer research in the twenty-first century [1, 2]. Since the emergence of computer, human-computer interaction has undergone a qualitative leap, that is, from the initial unilateral adaptation to computer to human-centered technology. The purpose of this change trend is to make the interaction more in line with people’s behavior habits. The new curriculum standard emphasizes that the classroom teaching mode adapting to the trend of the times is a problem that every teacher should be aware of. Teachers obtain objective and scientific evaluation through the analysis and diagnosis of their classroom teaching process, trigger teachers’ effective teaching reflection, clarify the direction of improvement, and promote teachers’ professional development. Students’ interest in learning is a critical factor influencing the quality of teaching during the teaching process. At present, intelligent teaching mainly facilitates teachers’ teaching and students’ listening and pays less attention to interactive visualization technology. In order to deal with the high efficiency, accuracy, and high demand of information dissemination, a clearer and intuitive visual presentation of information is very important. The way that users receive information passively alone has long been unable to meet people’s needs for obtaining complex data. The development of interactive information visualization has become inevitable and is displayed by relying on the visual interface [3, 4].

At present, most schools often carry out and organize intelligent education activities and then further improve teachers’ classroom teaching activities, so as to continuously improve teachers’ teaching ability. At present, big data technology is
mostly used as the core technology in intelligent education, but there is little research on interactive visualization and computer vision. This environment is not conducive to the advancement of teaching work, and there are many limitations and disadvantages, such as disturbing the classroom order and bringing pressure to teachers and students [5]. Domestic research on visualization focuses on the integration method of knowledge visualization and teaching, the design process of visual teaching content, and the lack of research on applying visualization to classroom teaching practice. The application of visualization tools in teaching emphasizes too much on the technology itself, and most of them do not explain what strategies should be used in the specific application of visualization tools. In view of this situation, only by grasping the impact of interactive visual computer vision application technology can we select the right entry point in the growing intelligent education market, accurately meet customer needs, and bring new growth points.

When a building integrates intelligent management systems, huge data storage, and analytics to facilitate and improve energy management, electrical devices on the grid that learn routines and adapt to behaviors are said to be an intelligent building system. Consequently, IoT and big data have been introduced, making equipment and service management intelligent and utilizing data analytics and technology and autonomous learning.

Through the research on the influence and trend of interactive visualization and computer vision application in the intelligent education industry, on the one hand, this research can give institutions that are ready to enter or have implemented online education and training and provide relatively professional opinions on new technologies and trends in online education market. And help them deeply understand the current situation and bottleneck of the online education and training industry, so as to carry out targeted R&D and breakthrough and realize new growth points. On the other hand, it plays a role in stimulating learning interests and improving teaching quality in daily teaching [6, 7].

On the basis of this study, I hope to promote the application of visual expression tools in classroom teaching. AI interactive coursework is used to present pictures, play knowledge animation, and show the problem exploration process. In the form of both graphics and text, it makes implicit thinking explicit and the knowledge relationship clear, which has attracted many teaching personnel and promoted the improvement of classroom teaching.

2. Research on the Application of Interactive Visualization and Computer Vision in Intelligent Education Based on Big Data Technology

2.1. Visual Processing of Teaching Information. The function of teaching multimedia equipment is becoming increasingly powerful as science and technology advance and intelligent teaching platforms emerge. In some software operations, it has won the favor of many teachers with its superior operation experience and smooth use. At present, most software has software versions of two device platforms, computer device, and mobile device. There are great differences in the use of the two platforms [8, 9]. In order to meet the expected teaching objectives across both platforms, the teaching information needs to be visualized and transformed in the form of three-dimensional information, so as to provide help for the application of AI technology [10–12]. After comparing a large number of documents, the three-dimensional space transformation mode of teaching information is determined, as shown in Figure 1.

The representation of teaching information in space is expressed in world coordinates, but when teachers run the platform to display teaching information, the coordinate system will be transformed into an observation coordinate system, which needs to be transformed between the two coordinate systems. The transformation from world coordinates to observation coordinates can be realized through translation, rotation, and scaling, which is called information coordinate transformation [13–15]. When observing the teaching information of three-dimensional space, two-dimensional images from different angles can be obtained by model transformation. The previous intelligent teaching platform mainly inputs through the keyboard and carries out a series of interactive operations through the mouse. After using big data AI technology, the interaction modes of intelligent teaching platform are very diverse. As shown in Table 1, due to the development of multipoint touch technology, users can directly input and interact with the mobile phone with their fingers without the help of other devices. In order to ensure the input accuracy, the touch pen equipped has disappeared. Gesture interaction is more in line with the user’s usage habits and widely used, so it has become a mainstream interaction mode today. It is necessary to process and transform teaching information in order to achieve a high-quality interactive effect.

In Table 1, finger touch and basic gesture recognition are the most commonly used interaction modes, and the use of intelligent education platform is completed through simple gestures. According to this interaction mode, the 2D coordinates in the information are transformed into 3D coordinates. Model transformation requires 3D homogeneous coordinates, and all the following homogeneous coordinates refer to 3D homogeneous coordinates [16]. Column vector \((x, y, z, s)\) is a homogeneous coordinate. If the real number \(p\) is nonzero, \((px, py, pz, ps)\) and \((x, y, z, s)\) represent the same point in the homogeneous coordinate system. Point \((x, y, z)\) in three-dimensional Euclidean space corresponds to point \((x, y, z, 1)\) in homogeneous coordinate system. When \(q\) is nonzero, the homogeneous coordinate \((x, y, z, q)\) corresponds to the three-dimensional coordinate \((x/q, y/q, z/q)\). If \(w\) is zero, then \((x, y, z, 0)\) corresponds to an ideal point at infinity. After the spatial transformation of the object proposed in the teaching content, set the scale of the object as

\[
k = Pk.
\]

At this time, the coordinates of the object in the teaching content in the intelligent teaching platform can be expressed...
For interactive teaching computer vision detection, it will make it difficult to detect moving light spots. However, to improve the level of intelligent teaching, light spots must be accurately extracted; otherwise, it will directly affect the follow-up work. Generally speaking, there are two situations in the image sequence containing moving targets: one is the static background, which usually occurs when the camera is fixed, so the video image background is static; the other is changing the background, which usually occurs when the camera moves, so the background of the generated video image is changing [17–19]. In this paper, the former case is mainly studied.

Big data AI technology is being used in the process of intelligent education; in addition to transforming the course content into visual content for interaction, it is also necessary to detect and capture the actions of teachers in the classroom, so that the human-computer interaction control process can be realized. Usually, when AI technology is applied, two cameras will be installed in the classroom to collect teachers’ actions. Assuming that two simplified pinhole model cameras (without image distortion) are placed in the space, their projection centers are $A$ and $A'$, respectively, so that they can observe the same object $D$ at the same time; two images $A$ and $A'$ can be obtained on the projection planes of camera $a$ and camera $a'$. The plane determined by points $D$, $A$, and $A'$ can be defined as $\beta$, which is called the polar plane. The intersection of the polar plane and the two imaging planes is called the polar line, that is, the straight line connecting $d$ and $o$ in space. According to the above setting, the internal parameter matrix of the camera can be obtained in the camera coordinates, so as to obtain the camera pixel coordinates and construct the basic detection matrix. After obtaining the basic matrix, given any feature point on any camera, judge the possible position of its image on another camera through the internal parameter basic matrix. Since the basic matrix is a matrix with rank 2, it can be determined that the corresponding possible position is on a straight line.

According to the above settings, in order to extract the target from the image, the image needs to be segmented. The target and background are separated by segmentation technology, so as to provide basis for subsequent target analysis. Image segmentation methods mainly include threshold method, region tracking method, edge detection method, and so on. Threshold segmentation is a popular image segmentation technique. The threshold method takes advantage of the different grey levels of the target object and the image background and treats the image as two kinds of regions with different grey levels, with the target object being one type of region and the background being another [20, 21]. Then, choose a threshold to assign each pixel in the image to one of the regions. The final result is the binary image. The specific threshold segmentation process is as follows:

$$L(i, j) = \begin{cases} 1 & l(i, j) \geq T, \\ 0 & l(i, j) < T. \end{cases}$$
In the formula, $L(i, j)$ is the gray value of pixel $(i, j)$; $T$ represents the threshold; $l_{k+1}(x, y)$ represents the threshold value. After the image is divided, it is filtered, and the filtered image is used to detect teacher or student interaction. After comparing a large number of analysis, the interframe difference method in computer vision technology is selected to complete the dynamic detection process of interactive action. The basic algorithm of moving target detection is the interframe difference method, which is widely used. The idea is to segment and extract the moving region in an image using pixel-based time difference and thresholding between two consecutive frames or multiple frames. The specific calculation process is set as follows:

$$R(i, j) = \begin{cases} 1, & |I_{k+1}(x, y) - I_{k}(x, y)| > T, \\ 0, & |I_{k+1}(x, y) - I_{k}(x, y)| \leq T. \end{cases} \quad (4)$$

In the formula, $I_{k+1}(x, y)$ represents the video image of frame $k+1$; $I_{k}(x, y)$ represents the video image of frame $k$; $R(i, j)$ represents the binary image after two-frame image difference; $T$ represents the threshold of binarization. In the binary difference image, the area where the pixel is “1” is considered as the foreground area, and the area where the pixel is “0” is called the background area. According to the above calculation process, the image content collected by the camera is stripped, teachers’ and students’ actions during the teaching process are recognized, and the computer vision detection in interactive teaching is completed.

2.3. Realize the Teaching Process of Big Data AI Technology

The fundamental part of intelligent education is designed in the preceding paragraph. Some key points in intelligent education of big data AI technology are set in order to better realize the application process of interactive visualization technology and computer vision technology. Since the design stage of big data AI technology intelligent education follows the principles of “student-centered” and “student-centered,” Yao et al. and Posada et al. make rational use of virtual technology to create an appreciation situation in which students can participate and experience in person according to the course content, instruct students on how to conduct virtual learning activities, mobilize students’ learning enthusiasm, and let students study independently, think independently, and gain personal experience and understanding. The design of teaching activities emphasizes “unity of knowledge and practice.” In the process of learning activities by using virtual means, try to avoid simple knowledge explanations, but pay attention to the experience process in virtual teaching, so as to inspire and guide students to realize the communication with the course content in the virtual space. In view of the above situation, the rendering algorithm is introduced in this study to design the virtual space set in AI technology at a deeper level. Starting with the comparison of the similarities and differences between photorealistic rendering and nonphotorealistic rendering, this study systematically introduces the purpose, method, research content, and application of big data AI technology teaching scene rendering [22, 23]. On this basis, some main algorithms in nonphotorealistic rendering are discussed in detail to help improve the effect of intelligent teaching.

This study will use the lab model as the basis of rendering algorithm. The lab model of color image is a color mode formulated by CIE (International Lighting Commission). The device has nothing to do with the lab model. It can compensate for the fact that the RGB and CMYK models must rely on the color characteristics of the device. Because any color in nature can be expressed and processed in lab space, the color information described by the RGB image generated by camera CCD imaging can be mapped in lab space [24–26]. Because the lab model is device independent, in order to avoid the different color characteristics of RUB caused by different camera imaging, all color images are converted to the lab model for subsequent processing. To convert the RUB color space to the lab space, first convert the RGB color space to the CIE coordinate system, including

$$\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} \frac{a}{d} & \frac{b}{e} & \frac{c}{f} \end{bmatrix} \begin{bmatrix} R \\ G \\ B \end{bmatrix}. \quad (5)$$

According to formula (5), the space algebra of lab can be

$$L = n1\left(\frac{50 Y}{Y_0}\right)^{1/2},$$

$$a = n2\left[\frac{X}{X_0}^{1/2} - \frac{Y}{Y_0}^{1/2}\right],$$

$$b = n3\left[\frac{Y}{Y_0}^{1/2} - \frac{Z}{Z_0}^{1/2}\right]. \quad (6)$$

In the formula, $X_0$, $Y_0$, and $Z_0$ represent the reference white value. In AI technology-related equipment, the reference white is $R = G = B = 1$, so there is $X_0 = Y_0 = Z_0 = 1$. According to this principle, render the relevant scenes in the teaching content, use the linear interpolation method, import the obtained colors into the AI designer, and find the maximum and minimum values of colors. If the two colors are consistent, there are

$$hl = \frac{\max l - \min l}{\max v - \min v},$$

$$ha = \frac{\max a - \min a}{\max v - \min v},$$

$$hb = \frac{\max b - \min b}{\max v - \min v}. \quad (7)$$

In the formula, $v$ represents the preset color mean value. And there are

$$\min v < K v < \max v. \quad (8)$$

In the above formula, $K$ represents the rendering coefficient. According to this formula, the scene rendering is
reasonable and meets the requirements of intelligent teaching. By dynamically obtaining the elevation value of each data point in the teaching scene, the RGB color value of the elevation value of each data point can be flexibly set, and the lab component can also be dynamically adjusted to obtain the content to be expressed by the model. For example, all lab components corresponding to data points with large elevation values can be increased, or only any lab component can be increased. On the contrary, all lab components corresponding to data points with small elevation values can be adjusted down, or only any component in lab can be adjusted down, so as to enlarge the color range, make the color rendering effect better, and provide a more real AI environment for intelligent education. The research on the application of interactive visualization and computer vision in intelligent education based on big data AI technology is completed by incorporating the above-mentioned content.

3. Experiment

In view of some problems existing in the intelligent education of big data AI technology, this research puts forward corresponding settings for the application process of interactive visualization and computer vision. And try to solve some problems existing in the intelligent education of big data AI technology through these two technologies. In order to ensure that this research has certain practical significance, an experimental link is constructed to analyze the application effects of the two technologies.

3.1. Experimental Preparation. The experimental data comes from Middlebury data set, which is a widely used intelligent education interactive gesture tracking data set. It contains 10 groups of pictures; each group of pictures contains several photos, which are collected from two accurately calibrated cameras. In addition, the real data of parallax maps corresponding to the two images are also provided to compare the performance of different technologies and algorithms. The statistical results of experimental images are shown in Table 2.

Taking the above images as the sample set of this experiment, the teacher’s actions in the images are detected by using the preoptimization method and the optimized method of this study, and the corresponding analysis results are obtained.

3.2. Experimental Process. In this study, the experimental index is set as the detection accuracy of teaching interactive gestures. To improve the comparison effect, first compare the detection errors of the preoptimization method and the current best method. The specific contents are shown in Table 3. Take the contents in Table 3 as the control group and complete the follow-up analysis.

After comparing the above data, it can be seen that the detection ability of the preoptimization method for teacher interaction is relatively poor. After the overall accuracy test is completed, the X-axis error and Y-axis error of the tracking part of the teaching motion trajectory are analyzed. In this gesture tracking experiment, one of the pictures in the experimental group 2 is used as a dynamic interactive image, and it is detected and tracked. According to the previous experimental scheme of dynamic gesture detection, the experimental scheme is set as follows: after the successful detection of teaching interactive gestures between different groups, it shows that the detection target between different periods is the same target. The eigenvalue of the successfully detected teaching interactive gesture target is input as the motion model of the next frame and so on to complete the model update. Each time the model is updated, the centroid position of the feature points of each frame is recorded, which is added to the motion trajectory to form a tracking chain, and finally, the motion trajectory is output. Output it and analyze it as the experimental results, so as to determine that the technical method proposed in this study has corresponding practical significance.

3.3. Experimental Result. The data in the preceding table show that when the image is static, the detection accuracy of the optimized method has been significantly improved. When the data in Table 4 is compared to the data in Table 3, it is clear that the detection error ratio of the optimized method to the detection error of the current optimal method is relatively small, indicating that the detection accuracy of this method is relatively high. Subsequent dynamic interaction detection can be carried out. The specific experimental results are shown in Figures 2–4.

The above experimental results show that the detection results of the optimized method are consistent with the preset trajectory, with minor differences. In order to obtain more real experimental results, the detection results of the optimized method and the coordinate axis error of the preset trajectory are compared.

After analyzing the above experimental results, it can be seen that the error difference between the preoptimization method and the postoptimization method is small in the X-axis direction, but large in the Y-axis direction. After the fusion and comparison of the two methods, it can be determined that the overall error of the optimized method is small. By analyzing the experimental results and static detection results, it can be found that the optimized method has a good effect.

4. Discussion and Analysis

This study, when combined with theoretical research and practical research methods, provides a new perspective on
existing big data AI wisdom education. This paper is aimed at building a scientific AI education and teaching process, using artificial intelligence technology to reduce the repetitive and inefficient work of human analysis, effectively improving the efficiency and quality of classroom teaching behavior analysis, and promoting the diverse development of classroom evaluation methods, the development of teachers’ professional skills, and the development of students’ professional skills. The following are the study’s main points:

(1) This research is based on the new demands for classroom instruction in the age of artificial intelligence, focuses on the development of educational informatization, and integrates classroom teaching theory with artificial intelligence technology, computer vision technology, and interactive visualization technology. Present an innovative framework for analyzing classroom teaching behavior based on artificial intelligence technology, assist in-depth analysis of teaching behavior, make up for the shortcomings of current research methods, and provide theoretical reference for classroom education reform and teaching quality improvement.

(2) This paper introduces the popular and latest interactive gesture detection algorithms in nonphotorealistic rendering in detail, discusses these interactive gesture detection algorithms combined with the visibility problem, classifies and analyzes these algorithms, and summarizes their advantages, disadvantages, and applicable scenarios.

Each complete class is composed of several teaching sequences, and each teaching sequence can be divided into smaller teaching activities. With the maturity of technology, we can conduct more detailed research on the subdivided classroom teaching behavior, find the relationship between teaching links, and dig out the laws in the process of classroom teaching. The development of educational informatization is unstoppable. As technology advances, more integration methods between technology and classroom teaching behavior analysis will be developed to solve various unsolved problems, create a better integration of technology and classroom, and improve overall teaching quality. Despite the fact that this paper thoroughly investigates the application of interactive visualization and computer vision in intelligent education based on big data technology, it proposes some novel ideas and methods. However, because
effective visualization technology is a very difficult research field and the general graphics hardware is still developing at a high speed, there are still many problems worthy of research and urgent solutions in this field, which need to be continuously optimized in the future.

5. Conclusion

Due to time constraints, while this paper provides the implementation steps of intelligent education of big data AI technology and the design process of online integration environment, when it is applied to practical problems, some external tools must be used. It takes a lot of time to call external tools. Some tools are not very efficient, resulting in a certain waste of resources. Secondly, the gesture recognition and visual display of teachers and students are not clear enough, such as how to judge the simultaneous actions of students and teachers. Finally, in the debugging function of online integrated education platform, the display of debugging results can be further optimized to provide a better visual interface. This work will be carried out in the following work.

Data Availability

The data used to support the findings of this study are included within the article.

Conflicts of Interest

The author declares that there are no conflicts of interest.

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